Indicators to assess community-level social vulnerability to climate change:

An addendum to SocMon and SEM-Pasifika
regional socioeconomic monitoring guidelines

FIRST DRAFT FOR PUBLIC CIRCULATION AND FIELD TESTING   APRIL 2011

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Table of Contents

Acknowledgements

Authors' note:

These indicators to assess community-level climate change vulnerability are presented here as a first draft for field testing, circulation, and revision. Your comments are welcome, and we look forward to improving the draft as the science of assessing social vulnerability advances. Please send any suggestions to Christy Loper at christy.loper@noaa.gov .

1. Why assess social vulnerability?

Resource-dependent communities are particularly vulnerable to climate change, whose influence on our natural systems is already being felt. Projections point to large, potentially dramatic changes that are likely in this century. For marine and coastal systems, the direct effects of climate change include increasing sea temperatures, rising sea levels, shifts in the strength and timing of ocean currents, increased frequency of severe tropical storms, and higher ocean acidity. These alterations will have impacts that cascade through the ecosystem, ultimately affecting nature's ability to provide the goods and services on which communities depend. Social systems and sectors that depend on the marine environment will have to adapt in ways that are likely to include changes to the distribution and productivity of important fishery species, potential losses in tourism value (recreation and aesthetic) of important marine habitats such as coral reefs and beaches, and reduced effectiveness of protective features such as barrier reefs and mangrove forests. Changing climate impacts will also have larger effects on social and cultural ways of life in many societies. Adjustments will be needed at the same time people are coping with such direct impacts as changes in availability of drinking water, coastal erosion, and salt water intrusion and inundation of residential and farm lands, and underground water sources.

Natural resource managers and other conservation practitioners are beginning to review their approaches to marine ecosystem management with the aim of improving ecosystem resilience to climate change. In most cases, the resilience of ecosystems and human systems are interdependent: Building resilience in one will increase it in the other. Armed with good knowledge about the nature of these linkages and the implications of different management options, natural resource managers and community leaders have the best chance of identifying strategies that improve ecosystem resilience without exacerbating social vulnerability.

Understanding and mapping the linkages between social and ecological systems can be complex, but even a basic understanding of social vulnerability and its drivers can substantively inform future planning for coastal and marine management. Conventional vulnerability assessments have focused mainly on biological, physical, and environmental aspects. But the relationship of people to impacted physical environments and ecosystems and their capacity to cope with and adjust to the new situation play a fundamental role in the level of vulnerability to climate events and impacts. In other words, communities with varying capacity to respond to climate events will likely yield different levels of vulnerability. It is therefore important that biophysical and socioeconomic assessments be integrated and complement each other, to provide a holistic understanding of vulnerability to climate change. Here we present an approach for achieving a synoptic view of social vulnerability and adaptive capacity, and the implications for the management of marine systems in the face of climate change.

2. Why did we write this document?

The purpose of this addendum is to provide a minimum set of socioeconomic indicators related to climate change. These can be included in a socioeconomic assessment of any site for which climate change impacts are an important issue. The resulting information can then inform coastal management needs and adaptive management. This document is being added to regional socioeconomic monitoring guidelines produced by the Global Socioeconomic Monitoring Initiative for Coastal Management (SocMon)[1] and its Pacific counterpart, SEM-Pasifika, which aim to improve site management of coastal and marine areas by providing simple, user-friendly guidelines on how to conduct a socioeconomic assessment.   Such assessments help coastal managers incorporate community views into adaptive management of marine resources.

It has become evident over the last few years that many coastal and island sites are experiencing more climate-related events and impacts, which add stress to coastal and marine resources as well as the communities whose way of life is intimately connected with them. Coastal managers and conservation practitioners worldwide are beginning to get involved in efforts to understand and address critical climate-related issues, and there has been a growing need for indicators to help understand a community's vulnerability and adaptive capacity to changing climate. This addendum is therefore intended to add specific indicators for understanding social vulnerability and social adaptive capacity as it relates to climate change.

The intended audience is project managers, NGO staff, and community members who are interested and able to conduct a socioeconomic assessment to help understand a community's vulnerability to changing climate, and how it might plan to adapt.

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[1] Regional guidelines have been produced and are actively being used for Southeast Asia, Caribbean/Central America, South Asia, Western Indian Ocean, Pacific Islands, and West Africa. Copies of guidelines for all regions, including translation into local languages, are available at www.socmon.org. Please refer to regional guidelines for information on data collection methods, monitoring objectives other than assessing climate change vulnerability, and a broader list of references.

3. Defining social indicators

Vulnerability assessments involve tools and processes used to assess the vulnerability of a community and its natural resources to climate change. The approach recommended in much climate literature (including Marshall et al. 2010, USAID 2009, Turner 2003) covers three main areas: exposure, sensitivity, and adaptive capacity, as they collectively determine the level of vulnerability to climate change impacts. The human dimension, which is the focus of this addendum, is gathered to provide better understanding of the *social* aspects of exposure, sensitivity, and adaptive capacity of the assessed community.

In a social context, the following terms are defined as follows:

- **Exposure:** The extent to which a community comes into contact with climate events or specific climate impacts. Specifically, this includes areas of residency and resource use exposed to different climate events and impacts. For example, houses near the high-water mark may have high **exposure** to rising sea levels. Coastal sago palm plantations or near-shore taro patches may have high **exposure** to salt-water intrusion and inundation. Shallow reefs exposed to full sun in areas of low wind may have high **exposure** to increases in sea surface temperature.

- **Sensitivity:** The degree to which a community is negatively affected by changes in climate. Sensitivity is largely determined by the relationship of individuals, households, or a community to resources impacted by climate events, and by the degree of dependency on those resources . For example, if "exposed" sago palm plantations or taro patches are a main source of food and income for a community, family, or group of households, then they may have a high degree of **sensitivity.** If the exposed reefs are the main area of fishing that provides income and food for a community, that community is highly **sensitive** to the mass coral bleaching that results from a rise in sea surface temperature.

- **Adaptive capacity: The** potential or capability of a community to adjust to impacts of changing climate. Adaptive capacity is complex. It may be influenced strongly by a few key characteristics, or by a wide range of social characteristics. For example, a well-informed village with a strong traditional leader who is able to develop good plans and make decisions that help and involve all members of the community will likely show high **adaptive capacity.** A household that has diversified sources of income and supplementary livelihood options will likely have higher **adaptive capacity** to impacts of climate change than those that do not.

- **Social vulnerability to climate change is a function of exposure, sensitivity, and adaptive capacity.**

Most indicators in this addendum are related to social adaptive capacity, which is determined by a wide range of factors related to a community's sociocultural, economic, and political conditions, as well as relevant governance and institutional arrangements. The complexity of social adaptive capacity requires us to take into consideration different social characteristics of individuals, households, and communities simultaneously. Information related to social adaptive capacity is highly useful, moreover, because it helps determine vulnerability of people to climate change, and thus provides guidance on what really needs to be addressed in development planning and implementation to ensure that strategic adaptation considerations are well integrated. An understanding of social adaptive capacity is crucial to avoiding the negative impacts of poorly planned activities that may sometimes worsen impacts on those who are most vulnerable. Effective adaptation thus needs to improve and **enhance adaptive capacity** while **decreasing exposure and sensitivity** to climate events and impacts.

4. Social indicators chosen for this addendum

Users of these guidelines may select indicators and develop others that are relevant to their site. They are also encouraged to revisit the indicators in the main SocMon or SEM-Pasifika, as several of them can also help assess different factors of climate vulnerability. For instance, the existing indicator *perceived condition of resources* is closely related to the **sensitivity** factor of vulnerability, as it provides information on what people think about the condition of the natural resources on which they depend. Monitoring perceived condition of resources can also point to trends and changes in these resources, as well as reveal non-climate and cumulative impacts on these resources that need to be taken into consideration to address additional climate threats. The more a community is dependent on a resource, and the worse the condition of the resource, the more sensitive the community will be. *Location of coastal and marine activities* is another existing SocMon/SEM-Pasifika indicator that provides information on **exposure** to climate events and impacts, as it identifies the areas where livelihood activities take place. Several other existing indicators in the management /governance and stakeholder sections of SocMon and SEM-Pasifika may be revised to address local climate change issues at the community level as well.

Each site has certain characteristics that make some indicators more suitable than others for vulnerability assessment. A list of possible social indicators for each contributing factor to climate vulnerability could be quite extensive, especially in the case of indicators related to adaptive capacity that depend on specific local situations and that might encompass a wide range of social conditions. An expert workshop organized by the International Union for the Conservation of Nature (IUCN) was held in December 2010 with representatives from NOAA, TNC, SPREP, UNEP-WCMC, CSIRO, GBRMPA, and CORDIO[2] to review, discuss, and prioritize possible indicators of adaptive capacity. The minimum set of indicators proposed in this addendum reflects the selections resulting from the workshop. A figure illustrating the proposed indicators in the vulnerability framework, a table with examples of relevant purposes, and detailed description of these indicators will be the focus of the following sections.

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[2] The National Oceanic and Atmospheric Administration (United States), The Nature Conservancy, the Secretariat of the Pacific Environment Programme, United Nations Environment Program World Conservation Monitoring Centre, Commonwealth Scientific and Industrial Research Organisation (Australia), Great Barrier Reef Marine Park Authority (Australia), and Coastal Oceans Research and Development in the Indian Ocean.

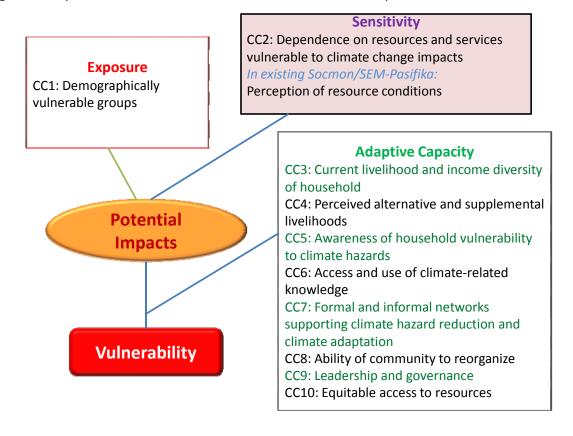**Figure 1:** Proposed indicators to address climate social vulnerability framework

Exposure
CC1: Demographically vulnerable groups

Sensitivity
CC2: Dependence on resources and services vulnerable to climate change impacts
In existing Socmon/SEM-Pasifika:
Perception of resource conditions

Potential Impacts

Vulnerability

Adaptive Capacity
CC3: Current livelihood and income diversity of household
CC4: Perceived alternative and supplemental livelihoods
CC5: Awareness of household vulnerability to climate hazards
CC6: Access and use of climate-related knowledge
CC7: Formal and informal networks supporting climate hazard reduction and climate adaptation
CC8: Ability of community to reorganize
CC9: Leadership and governance
CC10: Equitable access to resources

Table 1: Social indicators and examples of how they might be used

Area and Indicator number	Indicator and data collecting methods[3]	How information might be used
Exposure		
CC1	Demographically vulnerable groups **KI, S, HH**	• Identify which groups and areas may need the most assistance in climate change adaptation • Understand why certain demographic groups incur more climate-associated risk
Sensitivity		
CC2	Dependence on resources and services vulnerable to climate change impacts **S, M, BM, KI, HH**	• Predictor for future livelihood, economic, and food security impacts of climate change • Point to livelihoods that are highly sensitive to particular climate threats
Existing SocMon and SEM-Pasifika	Perception of resource conditions **HH**	Provide information on natural resource condition and ability to absorb additional impacts
Adaptive Capacity		
CC3	Current livelihood and income diversity of household **HH, KI, seasonal calendar**	• Identify economic sensitivity of community to climate change or other exogenous shocks • Identify need to develop diverse livelihood options
CC4	Perceived alternative and supplemental livelihoods **HH, KI**	Identify future livelihood possibilities and needed resources for adaptation to climate change or other exogenous shocks
CC5	Awareness of household vulnerability to climate hazards **HH (S, KI)**	• Understand particular areas of climate threat • Understand level of impact of different climate events on household and community • Prioritize adaptation efforts to address the most threatening impacts and events

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• [3] As in SEM-Pasifika guildelines, the following abbreviations are used for data collecting methods:
   - BM = Biological monitoring
   - FG = Focus group interview/survey
   - HH = Household survey
   - KI = Key informant interview/survey
   - M = Mapping
   - O = Observation
   - S = Secondary data

CC6	Access to, and use of, climate-related knowledge **KI, HH**	• Tailor types of outreach and education program to address climate hazards • Fill gaps in information networks • Identify current and possible uses of climate information
CC7	Formal and informal networks supporting climate hazard reduction and adaptation **KI**	• Identify potential networks to serve as conduit for climate-related information and assistance • Collaborate with existing networks that might support adaptation and planning
CC8	Ability of community to reorganize **KI, HH**	• Measure whether a community is able to restructure in the face of impacts • Determine level of self-reliance within a community • Identify areas that need to be strengthened for adaptation work
CC9	Leadership and governance **KI, HH**	• Utilize local support from community leaders in adaptation work • Understand level of stakeholder participation in management and decision-making
CC10	Equitable access to resources **HH**	• Identify vulnerable population segments that may be less able to adapt to climate change • Indicate overall level of community adaptation (higher equity = higher adaptive capacity)

CC1: Demographically vulnerable groups

Different groups in the same community or region may experience different levels of vulnerability to changing climate. *Demographically vulnerable groups* are those that, because of their particular demographic or social characteristics, are more vulnerable than others in the broader community. Particular demographic characteristics may result in varying levels of exposure to certain types of climate hazards (e.g. location of home, needed resources and infrastructure in relation to hazard-prone areas), how sensitive people are to hazards (age, health condition, occupation, economic status, or dependency on impacted resources), and their adaptive capacities (attitudes and knowledge, skills, economic status, social affiliation, and willingness and ability to change). These demographic characteristics may include:

- household size and structure
- age
- sex
- educational level
- literacy
- occupation
- income or economic status
- migration status
- home location and proximity to hazard areas
- health status and special needs
- affiliation with certain demographic groups, such as religious, ethnic , and language
- access to lifelines (drinking water, electricity, health care, transportation, and telecommunications)

How to collect the data **(KI, S, HH)**

Ideally this indicator will be addressed using both key informant and household interviews/census data. Key informants should be interviewed to determine which segments of the population may be most at risk to different types of climate events, where they are, and how to reduce those risks. Key informants might include the village chief or members of parliament, representatives from certain demographic groups (such as women, elders, and ethnic groups), representatives of occupational groups (fishers, farmers), and those who serve the community in certain capacities (such as health care workers, utility service providers, directors of emergency relief organizations, church leaders). Existing secondary sources can then be used, such as government census and existing demographic reports, to get information on the relative proportion of vulnerable groups within the community.

If secondary source data is not available and the community has less than 100 households, a full census survey (interviewing all households, not just a sample) can be conducted to obtain detailed demographic profiles to get an accurate understanding of site demographics. The following examples show how some demographic data can be collected by household survey questionnaire.

Examples:

Please fill out the following for each household member.

Household member*	Age	Sex	Education/ literacy	Occupation	Any special health needs
Mother	*48*	*F*	*College*	*Nurse*	*None*
Grandmother	*74*	*F*	*High school*	*Retired*	*Needs wheelchair*
Son	*22*	*M*	*High school*	*Fisherman*	*None*

*Identify all living in house by role (e.g. father, mother, grandmother)

Is your house exposed to any of the following climate impacts:

Climate hazards*	Check if yes
Tropical storm (e.g. hurricanes, typhoons)	
Storm surge	
Coastal/beach erosion	✓
Salt-water inundation	✓
Flood	
Climate-related land or mud slide	
Bush fire	
Other (specify_____)	
*Customize for your site, as some hazards may not apply, while others may apply to all homes.	

Compared with other families in your community, how would you rate the economic status of your household?

_____ Below average   _____ Average   _____ Above average

How would you rate your household income level, based on your expenses?

    _____ Usually not enough to cover important household expense
    _____ Just enough to cover important household expenses
    _____ Usually have some left after important household expenses

Are you newly migrated into the area? _____ No   _____ Yes, since _____

What is the main language(s) spoken in your household? _____

What is your household religious affiliation? _____

Does your household have the following?

Lifelines	Yes or no	If relevant, identify them
1. Back-up for electricity		
2. Back-up for drinking water		
3. Tools to catch or grow food		
4. Land vehicles		
5. Boat/canoe		
6. Radio		
7. Telephone		
8. Internet access		
9. First-aid kits		
10. Access to shelter		
11. Access to health care		x

How to analyze the data

Keep in mind that while demographic indicators may contribute to understanding community profiles and vulnerabilities, it is often important to consider other social indicators as well. Older people, often taken as one of the most vulnerable demographic groups, for example, who may have lived through climate hazards, might have developed coping mechanisms that give them more resilience than other age groups. Some people with low incomes have secure access to resources for subsistence, and so may be more adaptive than people with higher income who have no knowledge or skills for producing or gathering their own food. Women might be supported by different social groups and networks, or be equipped with livelihood diversification strategies that allow them to be more adaptive to climate impacts than their counterparts at different sites or who lack such networks or strategies.

Synthesize the data collected from secondary sources and key informants. Aggregate the data from the household survey to determine the percentage in each of the demographic categories. Compare the results to any existing data to understand changes over time. A short narrative is a great tool to describe the demographic makeup of the site, how it has changed, and demographic groups that are likely to be more vulnerable, as well as explanations of why this may be.

How the information can be useful to managers

Variables that identify the demographic diversity of a community can help managers understand the characteristics of the community they are working with and plan relevant adaptation strategies. This information also helps point out groups that may be more vulnerable, such as people with physical or mental health issues that make them dependent on others, newly migrated families who may not understand the local language and lack local social networks, and people with economic hardships and limited access to resources, all of whom are generally less able to prepare, respond to, or adapt to climate hazards. At the same time, informal social networks might help them to be less vulnerable to hazards, as well as being their only source of disaster assistance. Understanding levels of literacy, education, sex, and age could help in developing more appropriate types of outreach and methods of informing respective groups about climate and risks. Information on occupations and education level could be useful for developing programs that enhance adaptive capacity, such as alternative livelihood training. In communities where religious affiliation is strong, religious services or meetings might be a means of reaching people, and support from religious leaders may be crucial for local participation and success of project implementation. In other communities, high outmigration of young people could be an indicator of few acceptable or available livelihood options, which could alert decision and policy makers to develop programs to address this issue.

CC2: Dependence on vulnerable resources and services

Dependence on resources and services is a measure of how dependent households are on local resources that are vulnerable to climate impacts for their food security, income, physical protection, or other sociocultural aspects. These resources might be natural, such as ecosystems and their products and services, or man-made infrastructure, such as jetties, coastal roads, and other facilities and services including schools, public health centers, and utilities (e.g. power plants and water reservoirs).

How to collect the data (S, M, BM, KI, HH)

The first data to collect is that which will help identify the types of resources and services vulnerable to climate change. Relevant data collection methods may include:

- **Secondary sources:** These include scientific reports on climate change, impacts, and threats to local resources such as coral reefs, beaches and coasts, crops, and forests.

- **Community mapping:** Community members are invited to create maps that show (1) the types and location of natural resources that they depend upon, (2) community infrastructure and services, (3) areas where key social and economic activities take place, and (4) areas impacted or threatened by climate hazards (see Rambaldi 2010).

- **Physical and biological assessments and monitoring:** This data can provide an understanding of physical resources, current biological conditions, and changes. It can also help identify climate-related problems and threats to physical areas, species, and ecosystems.

- **Seasonal calendar:** Community members or representatives of occupational groups are invited to review annual seasons and climate events (e.g. rainy/dry season) and associated use of natural resources and social activities (e.g. traditional ceremonies or local customs). This can provide an understanding of potential social and natural impacts from changes in seasonal events, and how to prepare to deal with them.

- Having identified the resources and services that are vulnerable to climate hazards, ask **key informants** to identify the major activities conducted by households in the area (i.e., fisheries, tourism, aquaculture, etc.). Then ask them to estimate the percentage of each good and service produced that is used for personal consumption or income generation. Ask key informants also about the importance of ecosystems that may provide physical protection to the community (e.g., reefs and mangroves).

- A **household survey** can be used to list resources, related goods and services, and percentage of dependency in terms of both personal consumption and income generation. The importance of cultural value and services and physical protection provided by the ecosystem can also be recorded.

It is important to keep in mind that many resources are impacted or threatened not only by climate, but also by man-made causes such as pollution, sedimentation, overfishing, destructive fishing methods, and coastal development. In areas where such non-climate factors are present, the cumulative impacts need to be taken into consideration as well.

How to analyze the data

Add up the data from all the key informants or surveyed households and calculate the average percentage of each resource to see the level of dependency on each.

Example: Percentage of community dependent on coastal and marine resources

Resource	Related goods and services	% household use	% sale (income generation)
Coral reefs	Fisheries	60	40
	Tourism/Recreation	10	90
	Cultural value and services	n/a	n/a
	Island protection	n/a	n/a
Mangroves	Wood for building	100	0
	Wood for charcoal	100	0
	Fisheries	80	20
Upland areas	Crops	80	20

How the information can be useful to managers

The extent to which households are dependent on coastal and marine goods and services is an important indicator of how sensitive they could be to related climate events. This information offers insight into the importance of different ecosystems and resources to the community in terms of food security and income, social and cultural practices, and other services. Cross-referenced with information on resource condition, this information can also be used to identify threats and possible negative impacts to particular resources on which the community depends heavily. When cross-referenced with information on livelihood alternatives, it can help managers understand the range of possibilities and

limitations of a diversified economic structure at the site, and thus develop scenarios related to food and income security that mitigate problems. For example, if a household's sources of protein and cash income are primarily dependent on fishing and harvesting in reef areas, the impacts of mass coral bleaching or other forms of reef degradation are likely to threaten its food security and income source. Alerted to this, managers may begin working toward adaptation strategies that support alternative livelihoods that are not reef-dependent.

CC3: Current household livelihood and income diversity

Livelihood and income diversity is the level of household engagement in strategies and activities that support subsistence and generate income. Household livelihood diversity may be shaped by the availability of resources, social norms and institutions, local customs related to resource access, traditional and local tenures, and social relations (social norms related to gender and age groups), as well as economic opportunities (availability of demand, and access to market).

Livelihood diversification focuses on the process of creating diverse livelihood strategies, and related opportunities and challenges.

How to collect the data (HH, KI, seasonal calendar)

- **Household survey**. Before developing the survey questionnaire, consult with local residents who are knowledgeable about the range of livelihoods in the area, and include these choices in the questionnaire. The respondent might be the head of household or another member who knows about the types of livelihood pursued by each household member.

- Other data collecting methods, such as **seasonal calendar** and **key informant interviewing,** can provide in-depth information about livelihood diversification strategy in the community. In a coastal or island community, it is not uncommon for some younger adults to be engaged in seasonal employment outside the village to earn cash income—in a city, for example. A seasonal calendar can provide a visual timeline that gathers information about when certain weather patterns normally occur, and what seasonal events (fruiting season, tourism season, spawning aggregations) are associated with specific times of year. It can also provide information on such local practices as seasonal closures for certain species (see examples of participatory tools and methods on climate risk and seasonal calendars in WWF's Climate Witness Community Toolkit, WEBGEO Applied/FAO, and Atkinson et al.)

In some sites, livelihood diversification might be a critical adaptation strategy to climate change impacts, which is why this data should be collected. Related factors might include level of attachment to one's profession, skill level, interest and willingness to change occupation or residence, access to resources that would help create new livelihoods, and sociocultural norms that may support or inhibit livelihood diversification.

Example:

What are the main livelihood sources for your household for both cash income generation and household use?) Check all that apply.

Sources	For household cash income	For household use	Number of household members engaged in the activity, and their role
Fishing for finfish	✓	✓	2, grandfather and eldest son
Harvesting other marine life		✓	2, mother and eldest daughter
Farming	✓	✓	1, mother
Livestock			
Handicrafts	✓	✓	1, mother
Salary from employment	✓		1, father
Money received from relatives abroad	✓		
Private business ownership (e.g. stores)			
Pension/social security			1, grandfather
Tourism			
Other (please specify) ____Construction_____	✓		1, eldest son

How to analyze the data

The individual household survey will provide information on that household's livelihood diversity. Taken together, the household data could also be aggregated to calculate the proportion (percentage) of household engagement in each livelihood in the community. Combine responses to calculate the proportion of households with various levels of livelihood diversity, i.e. percentage of households with one, two, three, or more types of livelihood. Also cross-tabulate the types of livelihood with the number of male and female household members to understand the gender roles associated with different livelihood types. Summarize the information from the seasonal calendar and key informant interviews.

How the information can be useful to managers

Households that rely on a single economic sector for their livelihood (e.g., tourism or fishery) are more vulnerable to climate impacts than those that have a more diversified economy, especially if they are highly dependent on sensitive resources. Damaged or degraded resources could make it difficult to recover from an impact. Diverse income sources may also indicate higher willingness to change occupations in the face of hazards or other impacts. For example, research has shown that households with higher numbers of income sources are more likely to leave declining fisheries than those with fewer income sources (Cinner, Daw, McClanahan 2009). This information provides an understanding of both household and community level vulnerability, and is useful for livelihood development and intervention.

The information on livelihood diversification strategies provided by a seasonal calendar or key informant interviews is useful for identifying changes in normal seasonal patterns that may be associated with climate change, and to consider the impacts of future climate scenarios on seasonal events. It can also provide insight into how resources can best be managed, and what type of adaptation should be planned with seasonal limitations and opportunities taken into consideration.

CC 4: Perceived alternative and supplementary livelihoods

A livelihood is "made up of the capabilities, activities and assets (including both material and social resources) that contribute to a means of living" (Carney 1998). *Alternative livelihoods* are activities that household members could engage in to support their families if they were no longer able to pursue their current livelihood. *Supplementary livelihoods* are activities that might add to existing livelihoods. Sustainability of livelihood and income sources is a critical issue when a household faces growing impacts and challenges to that livelihood activity. A livelihood is considered sustainable when "it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base" (Carney in IMM 2008). The less sustainable a household's current livelihoods, the more important it is to develop alternative and supplementary livelihoods—where this is within the household's means, knowledge, and capabilities. Understanding households' perceived livelihood options can greatly inform adaptation strategies.

How to collect the data (HH, KI)

Conduct a household survey in which respondents are asked to identify possible alternative and supplementary livelihoods for their household, and (optionally) why each alternative livelihood was selected. Record any stories or anecdotes that illustrate why family members are or are not engaged in certain livelihood activities. Find out from key informants whether the livelihood options are seasonal, temporary, or potentially long-term. Also ask key informants whether there might be potential livelihood options at the community level of which households are not yet aware (such as a sustainable aquaculture project under development, or a government project on aqua or mariculture).

How to analyze the data

Make a list of the supplementary and alternative livelihoods identified, and order them from the most to least often mentioned. Summarize the requirements, opportunities, and constraints of each livelihood option and its potential sustainability.

How the information can be useful to managers

The availability of alternative and supplementary livelihoods, and the degree to which they are dependent on resources potentially impacted by climate, could influence the adaptive capacity of a household and its level of vulnerability. Research has shown that the availability of alternative livelihoods seems to lower perceived vulnerability and increase perceived resilience; households with alternative livelihoods do not rate their vulnerability to extreme events as high as those without (Wongbusarakum 2010). An understanding of available alternative and supplementary livelihoods can

also assist managers in designing new management and adaptation strategies so that new livelihoods can be developed and existing ones enhanced. The gathered information can also point to the types of training and capacity needed, which might be useful for designing a livelihood program that can help reduce pressure on impacted coastal resources by using more resilient or untapped resources. A community's more vulnerable demographic groups might be better supported to achieve alternative or supplemental livelihoods.

CC5: Awareness of household vulnerability to climate hazards

Awareness of household vulnerability of climate hazards measures a household's knowledge of susceptibility to climate hazards and its ability to cope with, recover from, or adapt to those hazards. Climate hazards are climate-related events that have the potential to cause harm. Households may be at risk for different types. Some may be transient—characterized by rapid onset and identifiable termination (such as a storm, flood, or drought). Others may result from a longer-term change in climatic variables (such as temperature or precipitation), be gradual, or result in related events such as sea level rise, mass coral bleaching, or ocean acidification. Household vulnerability to climate hazards is a function of three main factors: exposure, sensitivity, and adaptive capacity. It is important to keep in mind that different households in the same community may experience each of the factors at a different level, and thus have different levels of awareness about their vulnerability to the same types of hazard.

How to collect the data (HH)

A survey can be used listing possible climate hazards, where respondents are asked to check the types of hazard that are relevant to their household, and then rate their perceived level of vulnerability to each (low, medium, or high). Areas of vulnerability include (1) level of household exposure (frequency and severity) to a particular hazard; (2) level of household sensitivity to the hazard; and (3) degree to which the household is able to cope with the hazard.

To compare awareness of household vulnerability and recorded climate hazard impacts, information can be gathered first about local climate hazards (types, character, frequency, and degree of community impact) from existing secondary sources such as meteorological services, newspaper articles, scientific research, climate reports, hazard mitigation plans, and emergency declarations. Interviews can also be conducted with people who have knowledge of climate events and the impacts over the past several decades, such as local residents, technical experts, climate scientists, and others who have been involved in working with the community to prepare for and recover from climate disasters (village leaders, community elders, government officials, disaster mitigation officers, long-term project staff, etc.).

How to analyze the data

The rating of each component (A-D) for each hazard can be analyzed and compared with other hazards. In the following example, this household rates sea level rise and coastal erosion as very frequent and severe, and its own adaptive capacity to both events as low (i.e., high rate of difficulty coping). In terms of hazard type, the household rates itself as being more negatively affected by coastal erosion than by sea level rise, and this ranking is reflected in the household's overall score, which places coastal erosion above sea level rise.

Climate hazards and impacts	Which of the following climate events has your household experienced in the past 50 years? (Check all that apply)	A: How would you rate the frequency of this occurrence? 3= high, 2 = medium, 1= low	B: How would you rate the severity of this hazard? 3= high, 2 = medium, 1= low	C: How would you rate the degree of negative impact on your household by this hazard? 3 = high, 2 = medium, 1= low	D: How would you rate the difficulty of coping with this hazard, for your household? 3 = high, 2 = medium, 1 = low	Total vulnerability rating (sum of columns A through D)
Tropical storm						
Storm surge						
Sea level rise	✓	3	3	1	3	10
Coastal/beach erosion	✓	3	3	3	3	12
Saltwater intrusion into gardens/fields	✓	2	1	3	3	9
Saltwater intrusion into wells	✓	2	2	1	1	6
Changes in rainy and dry seasons, leading to changes in planting seasons, etc.						
Drought						
Flood						
Climate-related land or mud slide						
Brush fire caused by heat and dryness						
Increased water surface temperature	✓	1	2	1	2	6
Coral bleaching	✓	1	3	1	2	7
Hotter climate						
Cooler climate						
Other (specify) _____						

How the information can be useful to managers

It is important for managers to understand household awareness and perception of vulnerability to different types of climate hazards so that this information can inform the choice of adaptation strategies. For example, if there is little awareness of climate threats, programs need to be developed to inform people and help them prepare to cope. Priority in adaptation planning should be given to those hazards that have severe impacts at the household level, with a special focus on households that have identified themselves as being unable to cope with them.

CC 6: Access to and use of climate-related knowledge

Access to and use of climate-related knowledge measures household access to different sources of information related to climate change, climate variability, and its impacts, and how this information is used. It also includes access to any type of early warning system and can include past experience, traditional or local knowledge of climate patterns and events, as well as other sources of education, media, and communications.

How to collect the data (KI, HH)

Ask key informants to list all possible sources of climate information that are available locally or that can be accessed from a distance. This list is then used to create a household survey questionnaire. Respondents identify which of the sources is used by their household to access climate information, then asked to explain how the information is used.

Example:

Sources of climate-related knowledge	Check if you **get** climate information from this source, and n/a if the source is not available for your household	Check if you **use** this information, describing briefly how the information is used
Meteorological services	n/a	
Newspapers		
Radio	✓	✓ Not to go to sea when there is a coming storm
TV		
Internet	n/a	
School/teachers	✓	Not used
Visiting climate scientists/experts		
Village leaders	✓	✓ To dig out the river mouth to prevent flooding
From family and friends	✓	Not used
Government information		
Other (please specify) _____		

- If you have access to climate information sources, but do not use the information, please tell us why.
- Please tell us if there are any types of information that you need but cannot access, and what the barriers are to accessing the information.

How to analyze the data

To get an idea of how many people access a resource for climate-related knowledge, calculate the percentage of people who access the resource from the total. To see the proportion of sources used, add up for each the total number of people who list the source. The extent to which people who access a source use that information can be calculated as a percentage, by dividing the total number who *use* information from a source by the number who access it.

How the information can be useful to managers

Besides providing household-level information, the aggregated data provide an overview of a community's access to climate information. This tells managers how best to reach the community or particular households. It also helps identify gaps and problems. Greater access to, and use of, climate-related information should increase adaptive capacity by better preparing community members to cope with climate change.

CC 7: Formal and informal networks supporting climate hazard reduction and adaptation

Formal and informal networks are institutional and social networks that support preparedness for climate hazards and adaptation. *Formal institutional networks* may include those that are formalized with clear structure and supported by governmental authorities or institutions, such as hazard mitigation networks, health service networks or protected area networks. *Informal networks* are often formed through social connections in a group that shares common values, interests, engagement, or purpose. They could be large families, clans, church groups, women's groups, or occupational groups. In some communities, such networks may have been in place for a long time, but only recently begun to address climate hazards. In other communities, such networks may have already dealt with climate-related hazards that regularly impact the community. In the Pacific, such as on Namdrik Atoll in the Marshall Islands, traditional leadership institutions are being reinforced as they are used to reconnect to ancestral practices that help the community deal with climate hazards (Ishoda 2011).

How to collect the data **(KI)**

Identify key informants and ask them to describe formal and informal networks, their supporting role in climate adaptation and hazard mitigation, their history and length of time of supporting preparation for climate hazards, and their effectiveness. Key informants may include members or leaders of the networks themselves, community leaders, and representatives from groups with first-hand experience with climate impacts and adaptation. Information on processes, opportunities, problems, and challenges in relation to the role of networks should be recorded. In the case of formal networks whose purpose is hazard mitigation or climate adaptation, it is important to learn from both those who implement activities and those who are affected the perception of the quality and effectiveness of the program.

How to analyze the data

Notes from the key informant interviews can be synthesized and summarized in tabular format, as in the example below.

Networks supporting climate change preparedness (since when)	Number of members	% of community members in this group	Scope of climate change issues addressed	Gaps/needs of group

How the information can be useful to managers

In many societies, formal and informal networks contribute greatly to preparedness, response, and recovery. Knowing the availability and quality of these networks could help gauge a community's adaptive capacity, as these networks will provide security during times of change (shelter during disasters, financial support, and basic social support during difficult times). If no networks are available, or existing networks have challenges or problems, these are areas that could be addressed to improve a community's adaptive capacity.

Consider the totality of climate change issues facing the community. Is there a network or community group adequately addressing each issue? For example, if the community is facing sea level rise and coral bleaching, but there is only a network to watch for coral bleaching, there may be a need for a group that can monitor sea level rise.

CC8: Ability of community to reorganize

Ability of a community to reorganize refers to the degree to which it is able collectively to learn, plan, and make necessary changes to cope with climate-related impacts in such a way that the main functions of the community are sustained. This may require restructuring organizations, changing plans, shifting priorities, adjusting roles, carrying out activities in a different way, or applying lessons from the past to better face a climate hazard. *Degree of community reorganization* is a critical indicator of resilience to changing climate. *Level of community reorganization* is a function of factors including cooperation and collaboration among community members, planning for climate change, level of collectivism in the culture, community leadership, shared goals and responsibilities, and access to and support from other sources in reorganization.

How to collect the data **(KI, HH)**

Key informants should be those community members and leaders who are involved in collective activities, and they should be interviewed on issues related to the interest and ability of community members to work together to address external stresses. These could be related to climate or natural hazards. The key informants are asked to share their perspective on how well the community is able to reorganize in working collectively to confront the consequences of climate hazards, how it coordinates and collaborates, and the nature of shared goals and responsibilities among the leaders and members.

Survey questions can be included if a household survey is conducted to test whether community members share the same perspective as key informants.

Example:

On a scale of agreement from 1 to 5 (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree), please rate the following:

- Our community has plans in place to deal with climate-related events (such as a coral bleaching response plan) _____
- Our community is able to coordinate activities to respond quickly to the impacts of a natural event/hazard _____
- Our community is able to reorganize to respond to a new situation _____
- Our community has institutions that support us when we need to reorganize to cope with new situations or problems _____
- Our community members work well with each other_____
- Our community is able to access outside support when needed_____

How to analyze the data

If data is collected in a survey, tabulate the percentages of respondents in each category. If data is collected only from key informants, the table below might be a useful way to organize responses.

	(Strongly) Agree	*Medium*	*(Strongly) Disagree*
Our community has plans in place to deal with climate-related events (such as a coral bleaching response plan)			Low capacity of planning agencies
Our community is able to coordinate activities to respond quickly to the impacts of a natural event/hazard		Good at responding to storms; not equipped for tsunamis	
Our community is able to reorganize to respond to a new situation	Strong local leadership		
Our community has institutions that support us when we need to reorganize to cope with new situations or problems.	Most KIs placed the community here, but could not say why		
Our community members work well with each other		Some conflicts have occurred in the past	
Our community is able to access outside support when needed	Strong relationship with large grant organization		

How the information can be useful to managers

The results can help managers prioritize which areas within the community need to be strengthened. For example, if there is no plan or supporting organization, they can be developed. If people don't work well together, managers can explore the root causes and work to reduce conflicts by sponsoring collective activities. If access to outside support is critical to reorganization but lacking in the community, managers may prioritize grant writing or solicitation of technical support from outside organizations.

If the household survey reveals different perspectives than those of community leader informants, it could indicate a disconnect between the community and its leaders, an issue that perhaps should be explored, such as by sharing the results of the household survey with community leaders/key informants.

CC9: Governance and leadership

Governance is a very broad indicator that measures a variety of characteristics that together indicate how process and decisions are made to serve the best interests of the community and stakeholders. We focus here on leadership and stakeholder participation in management and decision-making. *Leadership* measures the presence of community leaders or government officials who can mobilize climate change responses and resources to support adaptation, and their effectiveness or credibility. This indicator is important because communities with strong, trustworthy, effective leaders will be more able to adapt. Stakeholder participation in management and decision-making is critical to buy-in of any new program related to climate change.

***How to collect the data* (KI, HH)**

This indicator is best measured through both key informant interviews and household surveys. Ask key informants which community leaders are engaged in climate change, including which sectors they represent (private sector, environment, technology, grassroots organizing, etc). Consider asking about these leaders' approaches and achievements in handling climate-related issues, depending on the sensitivity of this question in the local context. Then, in a household survey, ask a series of attitude questions to assess whether household respondents perceive the existence of community leaders who can effectively guide and direct members to prepare, respond to, and adapt to climate hazards; who they are; and how effective/ trustworthy. Also ask about the level of stakeholder participation in management, and their satisfaction with the decision-making process.

Example

For each statement, rate your level of agreement.

1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree

_____ Our community leaders have successfully led us through climate hazards in the past.
_____ Our community leaders are interested in climate change issues and the impacts on our community.
_____ Our community has leaders who have knowledge and skills to effectively take charge of climate change adaptation.
_____ I trust our leaders to lead the community through climate change adaptation.
_____ Our community leaders/government officials inform us of national or regional climate change policy or initiatives that may impact our community.
_____ Our community leaders inform us where we can get climate-related information.
_____ Our leaders suggest to us what we can do to adapt to changing climate.
_____ Our leaders can provide us with the resources we need for climate adaptation activities.
_____ Our leaders encourage community members to take part in climate adaptation planning.
_____ My voice is heard in community planning for climate change adaptation.
_____ I have had the opportunity to participate in community-level decision-making

How to analyze the data

Tabulate the responses so that you know what proportion of households "strongly agree" or "agree," versus "strongly disagree" or "disagree" to each statement. In general, the higher the level of agreement with the statements, the higher the community's adaptive capacity. In the example below, a relatively high proportion of respondents agreed that their community leaders have led them through climate hazards successfully in the past, but high percentages indicated that the leaders do not inform them sufficiently , indicating that there might be questions about the given leaders' ability to communicate and distribute information.

Selected statements	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Our community leaders have successfully led us through climate hazards in the past.	40%	30%	12%	7%	11%
Our community leaders/government officials inform us of national or regional climate change policy or initiatives that may impact our community.	19%	16%	4%	23%	38%
Our community leaders inform us where we can get climate-related information.	10%	10%	10%	34%	36%
I trust our community leaders to lead our community through climate change adaptation	15%	45%	2%	22%	16%
My voice is heard in community planning for climate change adaptation.	5%	10%	7%	33%	45%

How the information can be useful to managers

The way decisions are made has significant bearing on the outcome of those decisions. The effectiveness of leadership will impact how change is undertaken within a community. Trust of government will impact how receptive communities are to new adaptation strategies and livelihood initiatives. Meaningful participation of community members in the management process will improve the chances of success in any new climate-related initiatives, as it ensures that all have a voice in decisions that could affect their lives.

CC 10: Equitable access to resources

Equity refers to who wins and who loses as various climate change adaptation policies are considered (Adger 2005). *Equitable access to resources* measures whether community members perceive themselves as having the same rights and ability to use natural resources as other community members. Equitable access by all demographic groups to services, knowledge, social networks, livelihood opportunities, decision-making processes, etc. may play a very important role in a community's adaptive capacity.   Equitable access to resources can also encompass access to services and benefits available at the community level.

How to collect the data **(HH)**

This indicator is best measured in household interviews with a series of perception-based questions that address access to natural resources and to benefits provided by government or community assistance programs (such as cash benefits, training in alternative livelihoods, information about climate change, disaster relief).

1. *Compared with other households in my community, my household has*
    a. more access to marine resources
    b. less access to marine resources
    c. the same access to marine resources

2. *Compared with other households in my community, my household receives*
    a. more benefits from government's assistance programs
    b. less benefits from government's assistance programs
    c. the same benefits from government's assistance programs

How to analyze the data

Compute the percentages for each response.

Statement	% of respondents
1. Compared with other households in my community, my household has	
a. more access to marine resources	33%
b. less access to marine resources	47%
c. the same access to marine resources	20%
2. Compared with other households in my community, my household receives	
a. more benefits from government's assistance programs	25%
b. less benefits from government's assistance programs	50%
c. the same benefits from government's assistance programs	25%

How the information can be useful to managers

Communities that have a higher proportion of members who feel they have less access to marine resources, service benefits, and opportunities than others have lower perceived equity. This information can be used to compare communities with different management regimes or to measure change over time if collected in a time series. It can also help identify particularly vulnerable households, which may need more attention in the event of a serious climate event. Data on access to resources among different socioeconomic groups can also be compared with perceptions of resource condition (an indicator in existing SocMon and SEM-Pasifika) or level of climate knowledge; this may highlight key areas to target for adaptation strategies. For example, if the leading clan claims resources are good, but others who do not have access to the best reefs claim that resources are poor, we have identified a key issue. This kind of feedback may also highlight where certain groups have better access to resources, and information about those resources, than others. Not only can this help determine adaptation actions related to equity, it can also help identify those with the deepest understanding of the resource, to help inform and develop adaptive strategies.

5. From vulnerability assessment to adaptation planning

Social vulnerability assessment is a process that engages those who are impacted by changing climate to provide input on their strengths, weaknesses, opportunities, and limitations in addressing climate events and impacts. The indicators above provide a first step toward assessing aspects that may contribute to community vulnerability and adaptive capacity. They are meant to be directional and relative, allowing for comparisons among different socioeconomic groups within a community or among communities, as well as changes over time. These indicators will need to be refined. Some locally developed indicators may be more appropriate, and can be elaborated based on our models. The effort to develop such social and economic indicators should be a rewarding, collaborative experience and provide a critical component to the overall vulnerability assessment process. The community engagement that informs these indicators will vary in depth and purpose according to locality and context. Sharing the results of any assessment with the participating community is very important. These indicators can potentially help communicate why certain adaptation strategies are recommended. Feedback can also help empower people to take action and mobilize their own resources and skills for the benefit of the community.

There is no single threshold that determines whether a community is considered vulnerable to climate change. That is why social indicators can help identify where to invest limited resources. For example, if assessment shows that many within a community are unaware of potential climate change impacts, but do have diverse sources of income, perhaps a climate change awareness campaign is called for. On the other hand, if some demographically vulnerable groups are aware of climate change impacts but have fewer income sources and perceive their community to be less equitable, climate adaptation strategies may involve improving access to resources and supplemental livelihood options. Over time, socioeconomic monitoring can help measure whether adaptation strategies have made a positive impact on reducing vulnerability: whether awareness of climate change impacts has been raised, or whether vulnerable demographic groups have better access to resources and more diverse livelihood strategies in place.

For coastal managers, results of the social vulnerability assessment will provide a better understanding of the conditions and characteristics of resource-dependent communities at their site, and point to opportunities for climate adaptation as well as problem areas that need to be addressed. But to fully develop locally appropriate adaptation strategies, and continue adaptive management that takes changing climate and its impacts on the community and the local natural resources into consideration, an integrated assessment is most likely required. Social information should complement climate prediction data and information on the physical and biological impacts of changing climate. Such an integrated approach allows for a more complete picture of the different facets of site vulnerability, well-informed management decisions, and holistic adaptation planning for climate change.

6. References and suggested readings*

*indicates references for community-based participatory tools to collect data

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